EDITORIAL

Machine Learning and Deep Learning

Currently, talking about Artificial Intelligence (AI) is for some people to talk about robots and science fiction films such as Terminator, Matrix, and I Robot, among others; for others, it is still a matter of reflection. Although there is some common basis, where at some point they diverge towards different paths for the creation of this type of films, Artificial Intelligence focuses on other objectives, such as Machine Learning and Deep Learning, so understanding them will give us a clear vision of where Artificial Intelligence is heading today.

Understanding what artificial intelligence is and how it can be emulated was a significant development, largely due to the contribution of Alan Turing. Thanks to the Turing Test[1], it is possible to have an overview of what intelligence is. Turing defined intelligent behavior as the ability to achieve human-level performance in all cognitive tasks, sufficient to deceive an interrogator. Later, the formal concept of AI was coined in the Dartmouth Summer Research Project On Artificial Intelligence, based on the proposal of researchers such as John McCarthy, Marvin L. Minsky, Nathaniel Rochester, and Claude E. Shannon, who met to propose the bases of learning and characteristics of intelligence that could be simulated by a machine[2]. After this, Russell and Norving[3] proposed that the AI's goal was to generate machines that behaved as if they were intelligent and could be broken down into various categories, such as systems that could think and act like humans and systems that could think and act rationally. Additionally, these machines could also perform various tasks, such as natural language processing, knowledge representation, automatic reasoning, machine learning, computer vision, and robotics, which have marked the AI's journey through time.

The passage of time resulted in specializations and a particular type of AI called Machine Learning (ML), which Samuel[4] defined as the field of study that gives computers the ability to learn without being programmed straightforwardly. Mitchell[5], from an engineering point of view, defines it as a computer program that learns from an experience E, concerning a task T and a performance measure R, if its performance in T, measured by R, it improves with experience E and then Géron[6] defines it as the science (and art) of programming computers to learn from data. Along with these definitions, this type of AI has been growing quite rapidly due to the amount of data available today (Big Data) and the Internet. Every second, the amount of data to process grows: that is why it has been divided into some categories, such as supervised learning, unsupervised learning, reinforcement learning, among others.

If we continue detailing ML, we come to the type of Deep Learning (DL), where its basis is Artificial Neural Networks (ANN). The first known ANN was the one proposed by McCulloch and Pitts[7], which

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[1] B.Y.A.M. Turing, "Computing Machinery and Intelligence by A.M. Turing 1 The Imitation Game 2 Critique of the New Problem", A M TURING, 1950.
[2] J. McCarthy, M.L. Minsky, and C.E. Shannon. "A proposal for the Dartmouth summer research project on artificial intelligence - August 31, 1955". Ai Mag., 1955.
[3] S. Russel and P. Norvig, Inteligencia Artificial: Un Enfoque Moderno, 1era ed. Prentice Hall, 1995.
[4] A.L. Samuel, "Some Studies in Machine Learning". IBM J. Res. Dev., 1959.
[5] T.M. Mitchell, "Does machine learning really work?". AI Mag., 1997.
[6] A. Géron, Aprende Machine Learning con Scikit-Learn, Keras y TensorFlow, 2da ed. O'Reilly Media Inc., 2020.
[7] W.S. McCulloch and W. Pitts, "A logical calculus of the ideas immanent in nervous activity," Bull. Math. Biophys., vol. 5, Nº 4, pp. 115-133, 1943.

is a simple computational model of how biological neurons in animal brains could work together to perform complex computations using propositional logic. Thus, an ANN in DL differs in the number of hidden layers, typically in an ANN, one or more hidden layers can be found, but in a DL ANN, it can have hundreds of hidden layers, each one with several different processing units (neurons). From the first ANN until now, both the types and architectures have grown. The problems that these types can solve, such as classification problems, computer vision and image interpretation, natural language processing, patterns in data, and detection objects, character recognition, among others. Likewise, the above can be applied in different areas, such as mining, agriculture, circular economy, climate change, education.

The most DL ANNs used today are the Multilayer Perceptron, Convolutional Neural Networks (CovNet), Recurrent Neural Networks, and Generative Adversarial Network. In particular, CovNets, thanks to the work of Yann LeCun, Yoshua Bengio, and Geoffrey Hinton, winners of the 2018 Turing Prize, have experienced an explosion in terms of their uses and applications[8]. In addition to it is the greater prominence that the different new computing capabilities have had, such as new hardware available for high-performance computing, for example, the GPUs (Graphic Processing Units). Thus, not only is a GPU needed to work with Deep Learning, but it can also be worked online, through Google Colab, Azure Microsoft, among others, allowing better and greater advances in this area.

Today, Artificial Intelligence, Machine Learning, and Deep Learning are in a stage of continuous growth; they will surely be the main axes for the development of computer science and humanity where they will be fused, not only hardware and software but also various technologies, such as nanotechnology, quantum computing, automation, among others. Thus, the creation of new knowledge around Artificial Intelligence, whether of intelligent machines, new algorithms, machine learning, deep learning, among others, will be tools to accelerate the transition towards a circular economy, where it is possible to design products and models of circular businesses[9].

In conclusion, the contribution of AI, its characteristics, objectives, and types can go hand in hand with humanity's evolution, traveling on a path of mutual benefit.

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[9] McKinsey, "Inteligencia artificial y la economía circular: La IA como herramienta para acelerar la transición", 2019. [Online]. Available: https://www.mckinsey.com/business-functions/sustainability/our-insights/artificial-intelligence-and-the-circular-economy- ai- as-a-tool-to-accelerate-the-transition/es-cl. [Accessed: 02-Oct-2020].